disorders. These women often need ongoing support so continuity of care is vital.

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## LESSON OF THE WEEK

# Severe weight loss caused by chewing gum

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Sorbitol intake should be considered in patients with bowel problems, chronic diarrhoea, and weight loss

About 10-20% of adults and adolescents are estimated to have symptoms related to functional bowel disorders, resulting in high healthcare costs.[1] We report two cases of chronic diarrhoea and substantial weight loss in which extensive investigations had been performed previously. However, final diagnosis was only established after precise evaluation of eating habits, which showed habitual ingestion of sorbitol, a widely used sweetener in food products which has laxative properties.

### Case reports

#### Case 1

A 21 year old woman had experienced diarrhoea and diffuse abdominal pain for eight months. She had four to 12 bowel movements with watery stools daily. She was initially suspected to have infectious colitis. However, as clinical investigation suggested no clear diagnosis and diarrhoea persisted, she was transferred to our department for further evaluation. At that time she had lost 11 kg and weighed 40.8 kg (body mass index 16.6). Laboratory analysis showed hypoalbuminaemia (albumin 30.7, normal range 33-50 g/l; total protein 64.3, 66-87 g/l). Further laboratory investigations (including antigastrin antibodies, antigliadin antibodies, endomysial antibodies, stool pancreatic elastase, and stool cultures) were normal. The colon had a normal macroscopic appearance on colonoscopy; histology showed no specific changes (single lymphocytes and plasma cells, no granulocytes, normal mucosal architecture) and no evidence of microscopic colitis. Findings of gastroscopy with deep duodenal biopsy, abdominal ultrasound, and computed tomography were normal. Stool collection showed that the patient produced large amounts stool—up to 1900 g daily (normal <250 g). Stool electrolytes were 71 mmol/l of sodium and 34 mmol/l of potassium. Using the formula, osmotic gap = 290−2([Na]+[K]) (× 2 to account for anions), we found the osmotic gap to be 80 mmol/l (normal <50 mmol/l), raising the suspicion of an osmotic purgative. When we questioned the patient further, we found that she chewed large amounts of sugar-free gum, accounting for a total daily dose of 18-20 g sorbitol (one stick contains about 1.25 g sorbitol). After she started a sorbitol-free diet her diarrhoea subsided—with one formed bowel movement daily on discharge from hospital. One year later she still had normal bowel movements (one or two formed stools daily) and had gained 7 kg (body mass index 19.5).

#### Case 2

A 46 year old man was admitted to our hospital because of diarrhoea and a weight loss of 22 kg within the past year. Extensive diagnostic procedures had been performed previously. Blood and stool investigations (including albumin, protein, antigastrin antibodies,

antigliadin antibodies, endomysial antibodies, stool pancreatic elastase, and stool cultures) and endoscopic and radiological examinations (gastroscopy with distal duodenal biopsy, colonoscopy, abdominal ultrasound, and computed tomography) were normal. Histology of colon biopsies showed an intact mucosal architecture with single lymphocytes, no infiltrating granulocytes, and no evidence of microscopic colitis.

On admission he weighed 79.9 kg (body mass index 25.8) and reported abdominal gas, bloating, and seven to 10 watery stools daily. Apart from slight abdominal tenderness his physical examination was normal. Thorough evaluation of the patients' history with detailed analysis of eating habits suggested that he might have sorbitol induced diarrhoea—he reported chewing 20 sticks of sugar-free gum and eating up to 200 g of sweets each day, which together contained around 30 g sorbitol. We therefore evaluated his stool electrolytes, which were 54 mmol/l for sodium and 33 mmol/l for potassium, resulting in a stool osmotic gap of 116 mmol/l. During a 24 h fast with intravenous fluid substitution diarrhoea stopped, also consistent with osmotic diarrhoea. The patient was then asked to resume his normal diet. Within one day he had four watery stools. After he started a sorbitol-free diet, diarrhoea completely subsided, with one bowel movement daily. Six months later he had gained 5 kg (body mass index 27.4) and had normal stool frequency (one formed stool daily).

## Discussion

Valid data on the prevalence of laxative misuse in unselected patients are lacking, but such misuse is thought to be the leading cause of chronic diarrhoea of unknown origin in patients studied prospectively.[2] A cost-benefit analysis showed that it was cheaper to screen for laxatives than to use diagnostic procedures in patients with laxative misuse.[3]

Both our patients consumed large amounts of sorbitol, which belongs to the family of polyalcohol sugars, like mannitol and xylitol, some of which are regularly used as laxatives.[4] However, sorbitol is also used as a sweetener in many sugar-free foods and drug products.[5] People with diabetes often eat dietetic foods containing sorbitol.[6] In addition, sugar-free or low sugar foods are increasingly eaten in Western countries by people without diabetes because they are low in calories and are less likely than sugar to cause caries.[7] As possible side effects are usually found only within the small print on foods containing sorbitol, consumers may be unaware of its laxative effects and fail to recognise a link with their gastrointestinal problems.

As sorbitol is poorly absorbed by the small intestine it acts as an osmotic agent. Ingestion of relatively small amounts (5-20 g) causes gastrointestinal symptoms like gas, bloating, and abdominal cramps in a dose dependent manner. Higher doses (20-50 g) may cause osmotic diarrhoea,[8 9] as in our patients, in whom prolonged use of sugar-free gum and sweets had led to substantial weight loss; in one of the cases it even led to hypoalbuminaemia as a result of malabsorption. These symptoms fulfil the criteria of severe nutritional risk according to the recently published guidelines of the European Society for Clinical Nutrition and Metabolism (ESPEN).[10] Consumption of just 20 g produces diarrhoea in about half of normal people.[11] When we questioned our patients closely, we found that they replaced the gum sticks frequently, which accounts for the high doses of sorbitol ingested. Such habits could partly explain why only a minority of people who chew gum develop diarrhoea. In addition to the osmotic effects, habitual use of chewing gum might also influence stool frequency by stimulating saliva, gastric juices, and intestinal juices and by increasing intestinal motility. Sorbitol consumption is also associated with irritable bowel syndrome.[12]

Analysis of stool composition is a simple and reliable way to clarify diarrhoea of uncertain origin.[13] In contrast to secretory diarrhoea, stools in osmotic diarrhoea have a large osmotic gap (>50 mmol/l) as a result of the unabsorbed solute. In addition, osmotic diarrhoea responds to fasting whereas secretory diarrhoea does not. Although extensive diagnostic procedures had been performed before, only a careful dietary history and the finding of an abnormally high osmotic gap led to the final diagnosis in both our patients.

In conclusion, our cases show that sorbitol consumption can cause not only chronic diarrhoea and functional bowel problems but also considerable unintended weight loss (about 20% of usual body weight). Thus, the investigation of unexplained weight loss should include detailed dietary history with regard to foods containing sorbitol.

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